PALEO
Revue d'archéologie préhistorique

26 | 2015
Varia

Microtus (Sumeriomys) bifrons nov. sp. (Rodentia, Mammalia), a new vole in the French Upper Pleistocene identified at the Petits Guinards site (Creuzier-le-Vieux, Allier, France)

Microtus (Sumeriomys) bifrons nov. sp. (Rodentia, Mammalia), un nouveau campagnol pour le Pléistocène supérieur français, reconnu aux Petits Guinards (Creuzier-le-Vieux, Allier, France)

Marcel Jeannet and Laure Fontana

Electronic version
URL: http://journals.openedition.org/paleo/3026
DOI: 10.4000/paleo.3026
ISSN: 2101-0420

Publisher
SAMRA

Printed version
Date of publication: 1 December 2015
Number of pages: 59-77
ISSN: 1145-3370

Electronic reference
Marcel Jeannet and Laure Fontana, « Microtus (Sumeriomys) bifrons nov. sp. (Rodentia, Mammalia), a new vole in the French Upper Pleistocene identified at the Petits Guinards site (Creuzier-le-Vieux, Allier, France) », *PALEO* [Online], 26 | 2015, Online since 26 April 2016, connection on 07 July 2020. URL : http://journals.openedition.org/paleo/3026 ; DOI : https://doi.org/10.4000/paleo.3026

Microtus (Sumeriomys) bifrons nov. sp. (Rodentia, Mammalia), a new vole in the French Upper Pleistocene identified at the Petits Guinards site (Creuzier-le-Vieux, Allier, France)

Microtus (Sumeriomys) bifrons nov. sp. (Rodentia, Mammalia), un nouveau campagnol pour le Pléistocène supérieur français, reconnu aux Petits Guinards (Creuzier-le-Vieux, Allier, France)

Marcel Jeannet and Laure Fontana

We are very grateful to Ms Margarita A. Erbajeva for her competent advice which enabled us to reduce our prospection field and save a lot of precious time. We also thank Christophe Petit for his help with the figures and the reviewers of this article for their helpful advice.

Introduction

1 The Petits Guinards site (Creuzier-le-Vieux, Allier, France) was discovered in 1981 during reconstruction work on the road embankment bordering the right bank of the Allier (fig. 1) and was excavated in 2003 (Fontana et al. 2003a, 2003b). The geomorphological and archaeological study demonstrated the secondary position of the remains discovered inside a bulge deposit at the bottom of the slope. It attests to Palaeolithic occupations at the base of a limestone scarp, originally located at the top of a slope and dismantled at the beginning of the Holocene. The study also showed that the conserved part of the site was significantly displaced to 100 m lower down, and that the internal organization of the site stratigraphy did not undergo any major

sedimentary reworking. Nonetheless, it was not possible to differentiate between any potential layers in the archaeological level, which reaches a thickness of 60 to 120 cm, due to the type of deposit (heterometric blocks in a silty matrix). The thirteen radiocarbon dates on bone and dental remains (food waste and objects in reindeer antler) place the occupations in a long time period ranging from 19 600 to 10 300 uncal BP. Several flints provide clear presence of a Solutrean occupation (Fontana et al. 2013), but most of the lithic industry is Magdalenian, as is the industry in hard animal matter (Fontana et al. 2003a, 2003b). The abundance of the latter (Fontana & Chauvière 2009; Chauvière et al. 2006) and the presence of the Solutrean are two original features of this Upper Palaeolithic site located in the Massif Central. The abundance and the excellent conservation of the bone remains are also remarkable. The 100 000 rodent remains include numerous temperate and boreal species, providing evidence of a continental climate: the mole (Talpa europaea), the common shrew (Sorex araneus), the greater white-toothed shrew (Crocidura russula), the field vole (Microtus agrestis) and emblematic species such as the Arctic lemming (Dicrostonyx torquatus), the Tundra vole (Microtus oeconomus), the Narrow-headed vole (Microtus gregalis), the Northern birch mouse (Sicista betulina) and the very abundant Russet ground squirrel (Spermophilus major) (fig. 2). Most of the rodent remains belong to six species of voles (including five Microtus), but some vole molars present differences, raising questions as to their affiliation to one of the six determined microtine species. The aim of this study is thus to identify the species represented by these dental remains.

Figure 1 - Les Petits Guinards, Creuzier- le-Vieux. Map of site location.

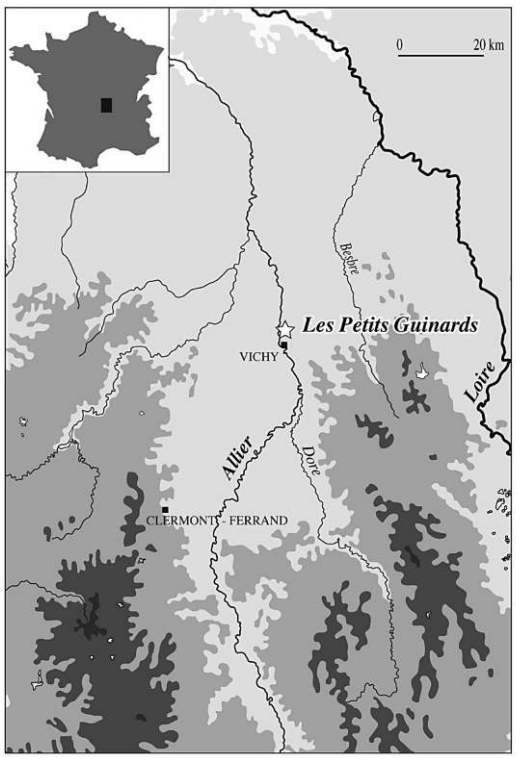


Figure 2 - Microvertebrate species from Les Petits Guinards.

RONGEURS	Noms vernaculaires	NMI
Microtus arvalis	Campagnol des champs	687
Microtus agrestis	Campagnol agreste	79
Microtus gregalis	Campagnol des hauteurs	919
Microtus oeconomus	Campagnol nordique	87
Microtus nivalis	Campagnol des neiges	4
Dicrostonyx torquatus	Lemming à collier	43
Arvicola terrestris	Rat taupier	276
Clethrionomys glareolus	Campagnol roussâtre	5
Apodemus sylvaticus	Mulot gris	9
Spermophilus major	Ecureuil terrestre	82
Cricetus cricetus	Grand hamster	1
Sicista betulina	Sminthe errant	1
ESPÈCES DIVERSES	**Noms vernaculaires**	**NR**
Talpa europaea	Taupe commune	16
Sorex araneus	Musaraigne carrelet	17
Sorex minutus	Musarraigne pygmée	5
Sorex minutissimus	Muraraigne naine	1
Crocidura russula	Musaraigne musette	1
Crocidura leucodon	Musaraigne bicolore	1
Neomys fodiens	Musaraigne aquatique	4
Lagomorpha	Lagomorphes	27
Salamandra salamandra	Salamandre tachetée	1
Bufo bufo	Crapaud commun	2
Rana temporaria	Grenouille rousse	46
Rana dalmatina	Grenouille agile	2
Rana arvalis	Grenouille des champs	7
Natrix natrix	Couleuvre à collier	3
Elaphe longissima	Couleuvre d'Esculape	3
Coronella austriaca	Coronelle lisse	1
Mustela nivalis	Belette	26
Mustela erminea	Ermine	8
Mustela putorius	Putois	1

1 – Dental morphology and morphometric analysis

1.1 – Dental morphology

2 The dental remains of small voles from the Petits Guinards deposits represent a minimum number of 430 individuals. The terminology of the occlusal surface elements of the molars is presented in figure 3. Sixteen m/1 and one M3/ present significant differences, and are at the limitations of the initial characteristics of the Microtus genus1. The general aspect of these molars is similar to the Microtus genus, but several characteristics sporadically observed in diverse species are combined here on members of this group with remarkable constancy and intensity: in particular the acuity of the projecting angles, the hermetic closing of the triangles and their very marked bucco-jugal symmetry. But, above all, although eight m1 present five triangles and two present six (fig. 4), surprisingly, the six other m1 bear seven closed triangles (sometimes converging to form a deformed rhombus tending to split), which only occurs in exceptional cases in other microtines. In addition, among the eight m1 with five triangles, each group of five triangles is preceded by a rhombus deformed by the penetration of the internal angle a7, which tends to create two new closed triangles: these m1 are thus part of the group of molars with seven closed triangles. Forms 7 and 17 (cf. fig. 4), with a very open rhombus, are separate from the other types. Lastly, a tight constriction isolates the anterior loop, which is extended by a characteristic spur on the external surface (t8), which never occurs elsewhere (cf. fig. 4, n. 13, 14).

3 What species do these M1 belong to? They could be attributed to two of the five microtine species identified at Petits Guinards (cf. fig. 2); Microtus arvalis and Microtus

agrestis, which are morphologically similar to this new arrival. M. arvalis differs by its smaller size, less acute bulging angles, practically no dissymmetry, a less developed and more rounded t8 (fig. 5). As for M. agrestis, the relatively frequent presence of six closed and angular triangles is similar to indeterminate Microtus (cf. fig. 5c), as it never presents seven closed triangles or such a bulging t8. Figure 6 presents the anterior loop of present-day voles from Finistère (where Microtus arvalis is naturally absent) and provides evidence of this; it associates a wide variety of chosen forms, from the most simple to the most complex, in order to avoid all confusion with the common vole (M. arvalis), its closest relative, naturally absent from Brittany.

4 This indeterminate vole differs from local microtines, but may perhaps be compared to boreal species issued from migratory populations, as such species are present in Petits Guinards? The comparison with Microtus hyperboreus Vinogradov 1933, the North Siberian vole, issued from the Lena Delta with a territory extending from the north of the Ural to the Jamal Peninsula appears to be an obvious point of comparison as it is the only Boreal microtine to be naturally associated with Dicrostonyx torquatus. Its m/1 bears five to six closed angular and dissymmetrical triangles (occasionally seven), which relate it to indeterminate Microtus. However, the t8 has no jugal spur and no constriction of the anterior loop is visible. In addition, the M. hyperboreus M3 bears an additional internal protruding angle. These differences appear to be sufficiently significant to rule out an attribution of the indeterminate microtine from Petits Guinards to this subarctic species.

5 It thus seems impossible to consider the indeterminate microtine from Petits Guinards as a subspecies of one of the presented microtines as the morphological differences are too marked and are beyond the variability of the Microtus genus. If we did not take account of these differences, we would have to redefine the whole systematics of the genus. The best example of this is the similarity between M. arvalis and M. agrestis, leading many authors to regroup them under the double label M. arvalis-agrestis (Chaline 1972; Desclaux et Defleur 1997; Sese 2005; Cuenca-Bescos et al. 2010). Yet, the criteria presented here for describing this new Microtus are much clearer than those likely to separate the two afroementioned species. This observation is all the more pertinent for the other analysed microtines. Do the morphometric data confirm this conclusion?

Figure 3 - Ondatra zibethicus.Terminology example of the occlusal surface of vole molars (from Hibbard, 1950, fig.16). a/ m1-m3 G; b/ M1-M3 G. AC: anterior cap; ACC: anteroconid complex; AL: anterior loop; BRA: buccal re- entrant angle; BSA: buccal salient angle; LRA: lingual re- entrant angle; LSA: lingual salient; PC: Posterior cap; PL: Posterior loop. TTC: trigonid-talonid complex.

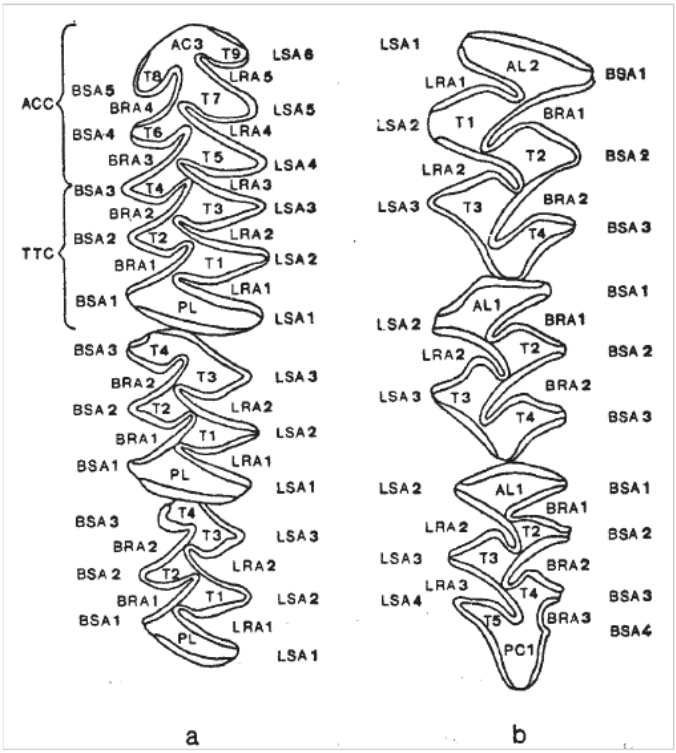


Figure 4 - Microtus bifrons - Les Petits Guinards, Creuzier-le-Vieux. Scale: 1 mm.

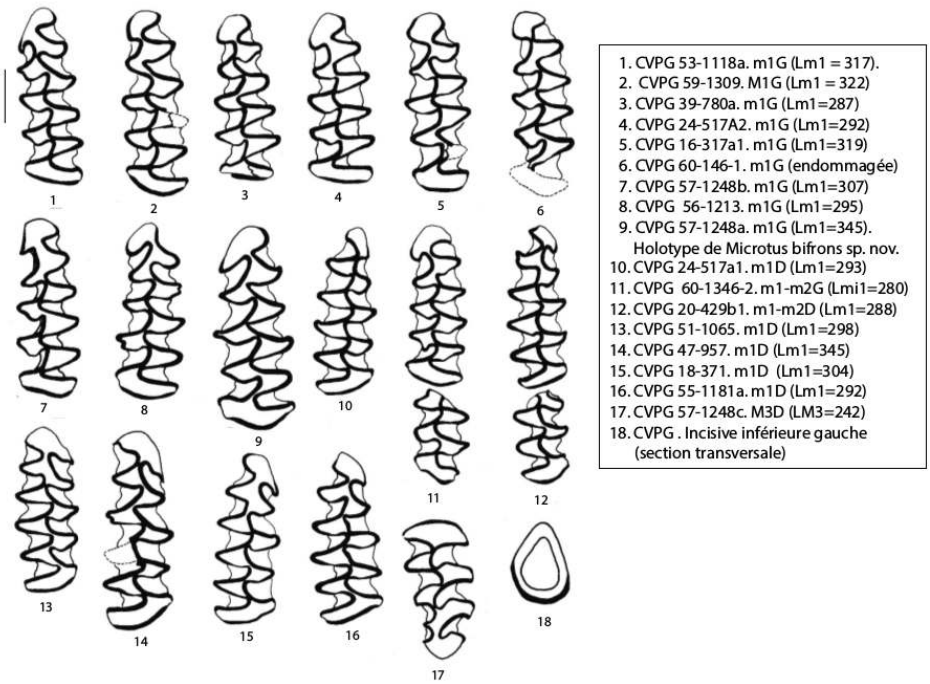


Figure 5 - a/ Microtus arvalis; m1, m2, m3 G; b/ Microtus arvalis: M1, M2, M3 G. ; c/ Microtus agrestis: m1, m2, m3 G; d/ Microtus agrestis: M1, M2, M3 G. Grotte des Romains, (Virignin, Ain) – Magdalenian (Excavations by R. Desbrosse).

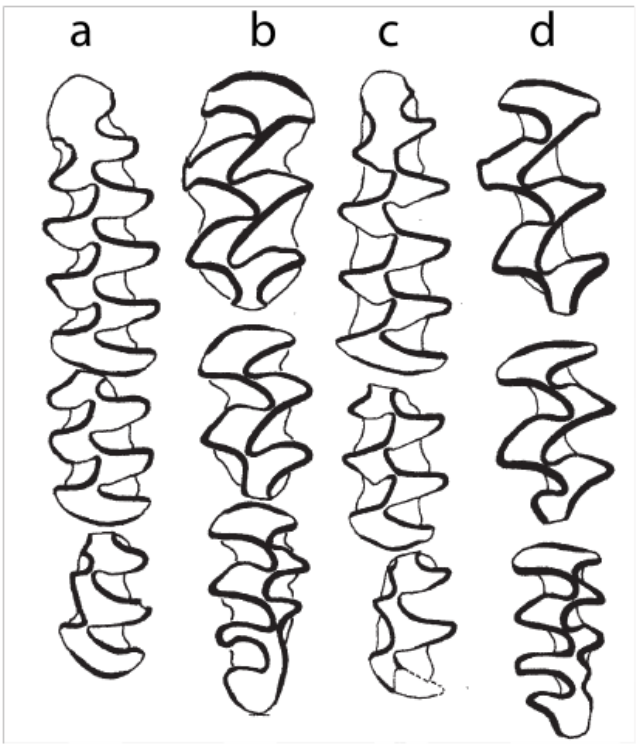


Figure 6 – Present-day Microtus agrestis from Finistère. Anterior complex from m1. Varied types are classified from 1 to 14 following the evolution of the closing of t6 and progressive development of t8 on the anterior loop (N.B.: Microtus arvalis is currently absent from Finistère, Côtes-d'Armor and Morbihan).

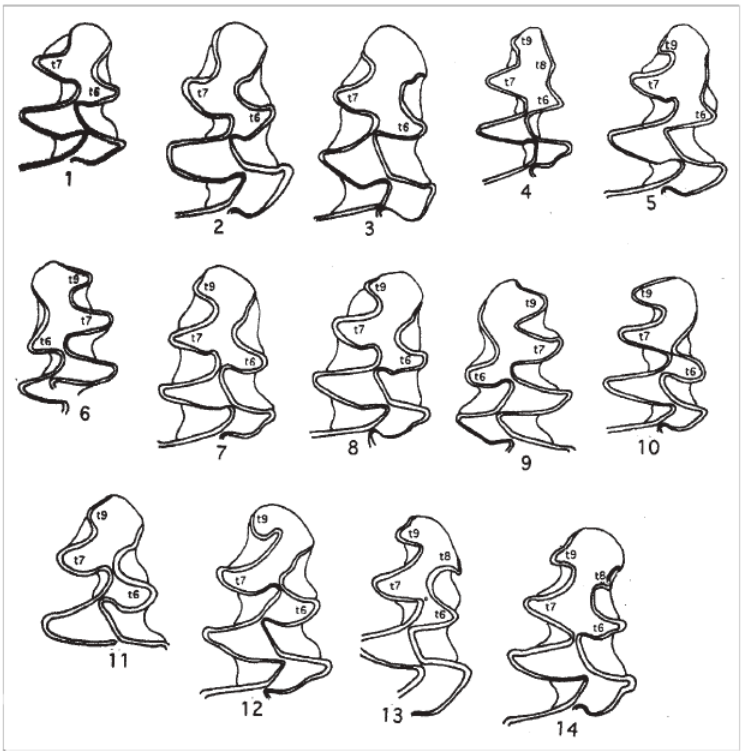
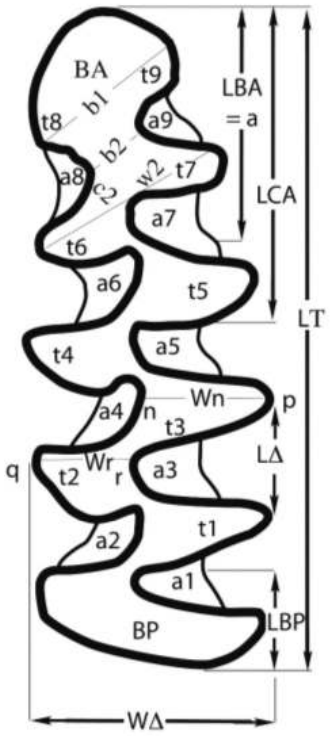


Figure 7 – Position of biometric points taken on Microtus M/1 (adapted from Van der Meulen 1973).



REPÈRES BIOMÉTRIQUES

b1: Largeur de la 1ère boucle
b2 : Isthme antérieur
c2 : Striation base BA
w2 : Largeur base BA
LΔ : Longueur mésoditale du trigonide
Wn : Largeur t3
Wr : Largeur de t2
LBP : Longueur mésodistale de BP
WΔ : Largeur de BP

Figure 8 - Comparison of morphometric values for the unidentified microtine from Petits Guinards and four other Microtines.

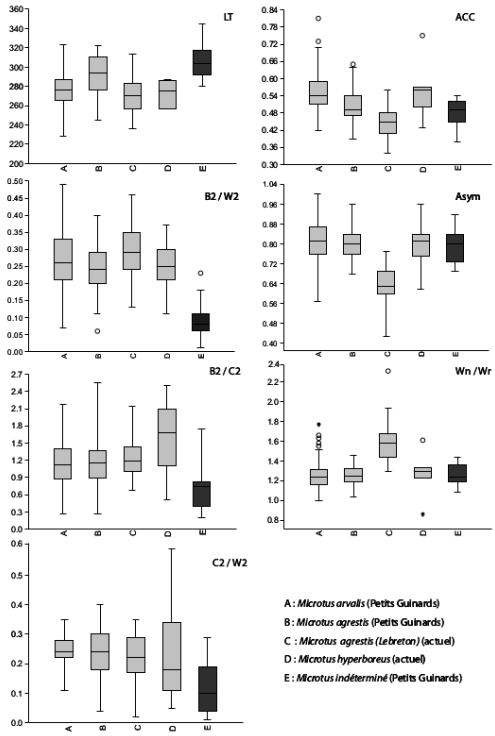


Figure 9 - Comparison of Microtus biometric data from Les Petits Guinards and four other microtines (M. arvalis, M. agrestis, M. agrestis Leb., M. hyperboreus), using the Mann-Whitney test. In grey: non-significant differences (p >0.01)

Longueur de la m1				
	MPG/arval	MPG/agres	MPG/agre L	MPG/hyper
U	125,5	184,5	44,5	3
z	-4,6	-1,64	-5,16	-3,46
p	4,20E-06	0,1007	2,39E-07	0,0005

b2/C2				
	MPG/arval	MPG/agres	MPG/agre L	MPG/hyper
U	180	90	84	13
z	-3,3262	-3,1042	-3,8799	-2,2375
p	0,0009	0,0019	0,0001	0,0253

b2/W2				
	MPG/arval	MPG/agres	MPG/agre L	MPG/hyper
U	46,5	30	20	5,5
z	-5,4702	-4,9176	-5,5426	-3,047
p	4,49E-08	8,58E-07	2,98E-08	0,002311

C2/W2				
	MPG/arval	MPG/agres	MPG/agre L	MPG/hyper
U	135	84,5	143,5	27,5
z	-3,9219	-3,2383	-2,773	-0,096731
p	8,78E-05	0,0012	0,0056	0,33339

ACC				
	MPG/arval	MPG/agres	MPG/agre L	MPG/hyper
U	185	208,5	229,5	19
z	-3,811	-1,136	-2,3394	-1,9891
p	0,0014	0,2560	0,0193	0,046696

Asym				
	MPG/arval	MPG/agres	MPG/agre L	MPG/hyper
U	441	258,5	31	43,5
z	-0,73238	-0,074221	-5,3793	-0,78129
p	0,4639	0,9408	7,48E-08	0,93773

Wn/Wr				
	MPG/arval	MPG/agres	MPG/agre L	MPG/hyper
U	445	262,5	28	36
z	-0,68429	0,010596	-5,4212	-0,087419
p	0,4900	0,9916	5,92E-08	0,93034

1.2 - Morphometry

6 The m/1 metric data from the five analysed morphotypes (from Petits Guinards: M. arvalis, M. agrestis and M. indet.; from the current collections: M. hyperboreus and M. agrestis Leb.) are grouped together in the annexed tables (annexes 1 to 5). We analysed seven variables for these five morphotypes (fig. 7): the length of the M/1, the ratio between the constriction of the anterior loop (b2) and the internal width of its base (W2) (following the Van der Meulen standards, 1973), the reduction ratio (b2/c2) for the two isthmuses of the anterior loop, the c2/W2 ratio, the asymmetry of the anterior loop (asym), the asymmetry/anterior complex ratio (ACC), the asymmetry of the trigonid (Wn/Wr). As the aim of this is to compare the indeterminate Microtus from Petits Guinards (called MPG) to the other described microtines, we tested the differences between Microtus indet. and each morphotype for each variable, using the Mann-Withney test. The results are presented in figures 8 and 9.

7 The length of the M/1 from MPG is significantly greater than that of three of the four microtines, with the exception of M. agrestis, like for the asymmetry/anterior complex ratio (ACC). The reduction ratio (b2/c2) is also significantly different between MPG and three microtines, with the exception of M. hyperboreus, like for the c2/W2 ratio. For c2/W2, the closing of t6 depends on the c2 value and can sometimes be considered as an evolutionary character of the molar which tends to get longer through the acquisition of an additional closed triangle. This is naturally the case for MPG which generally has seven closed triangles, as shown in the figure. The figure also shows the discrepancy of the c2/w2 index towards the lowest MPG values. According to the Mann-Withney test (cf. fig. 9), it is distinct from the two M. agrestis and M. arvalis types. The ratio between the constriction of the anterior loop and the internal width of the base (b2/W2) is significantly different between MPG and the four microtines. As for the asymmetry of the trigonid (Wn/Wr) and the asymmetry of the anterior loop (Asym), only the difference between MPG and M. agrestis Leb. is significant. In spite of a visual dissymmetric appearance of the anterior loop, the recorded values are uniformly incorporated in the mass of the other taxa, which is rather unexpected. We can consider this as confirmation of the attribution of MPG to the Microtus genus. The asymmetry of the (Wn/Wr) trigonid is only evident for the Breton Microtus agrestis (C). The visual aspect of this parameter thus appears to be illusory in a multi-specific association.

8 All of these differences illustrate three main facts. First of all, the microtine from Petits Guinards can be statistically differentiated on the basis of one parameter (the b2/W2 ratio). For four of the six other variables (length, b2/c2, c2/w2, ACC), the difference between MPG and the four other microtines is significant for three of them, which signifies that for each of these four variables, MPG is only similar to one of the four microtines, that is M. hyperboreus in two cases and M. agrestis in two cases. The two other variables (the two asymmetries) are only significantly different in one case, which is M. agrestis Leb. Furthermore, a single morphotype systematically presents significant differences with MPG (for the seven variables, cf. fig. 9); that is M. agrestis Leb.

9 Consequently, none of the four morphotypes is significantly similar to MPG, according to the measured parameters, which confirms that this microtine is a different species

to the local microtine species and the tested boreal species. The two dominant criteria are the presence of seven closed triangles on the M/1 (rarely six or eight), and the large size. The constriction of the anterior loop and the spurred t8 are also characteristic. On the other hand, the visually evident asymmetry does not resist to the biometric test. What species do these M/1 thus belong to?

2 – A Near Eastern vole in the Upper French Pleistocene?

2.1 - Microtus socialis and Microtus guentheri

10 The indeterminate Microtus from Petits Guinards does not thus appear to be a local type vole or a Siberian migrant, which incites us to seek its origin in lower latitudes and more rigorous climates. The latitudinal and climatic convergence could be compared to the gopher, which is very abundant at Petit Guinards and which extends to the semi-arid and steppe-like regions of south-western Asia. At this stage, only the literature provides information on this, without taking regional faunal associations into consideration. S. I. Ognev (1950) regrouped all the sub-generic mid-oriental forms of Chilotus Baird 1857 (North American microtine sub-genus) under the single specific name of Microtus socialis, the social vole, thereby demoting them to sub-specific status. According to that author, the domain of M. socialis extends from the north of the Black Sea to inland Mongolia and it also lives in low altitude semi-desert zones (fig. 10), like the gopher. The application of mitochondrial research (Yigit & Çolak 2002; Golenischchev et al. 2002a, 2000b; Jaarola et al. 2004; Yigit et al. 2012) modified this model by placing the the so-called subspecies into two main groups of species2: Microtus guentheri and M. socialis. These works also revised the distribution of M. socialis (by S.I. Ognev 1950), which extended over the geographic zone in the north Caucasus region and a large strip of the Black Sea to Kazakhstan (Corbet 1978; Gromov & Erbajeva 1995; Yigit et al. 2003; Yigit et al. 2012) (cf. fig. 10). This species was sporadically recorded in several Near Eastern sites (Kowalski 1958). As for M. guentheri, it extends to the Black Sea in the south, to Kirghizistan in the east (Lac Ala Kul), to the south (Lebanon, Syria, Israel and isolated occurrences in Cyrenaica) and to the west (Thrace and Bulgaria). For some researchers, its domain extends to the Balkans.

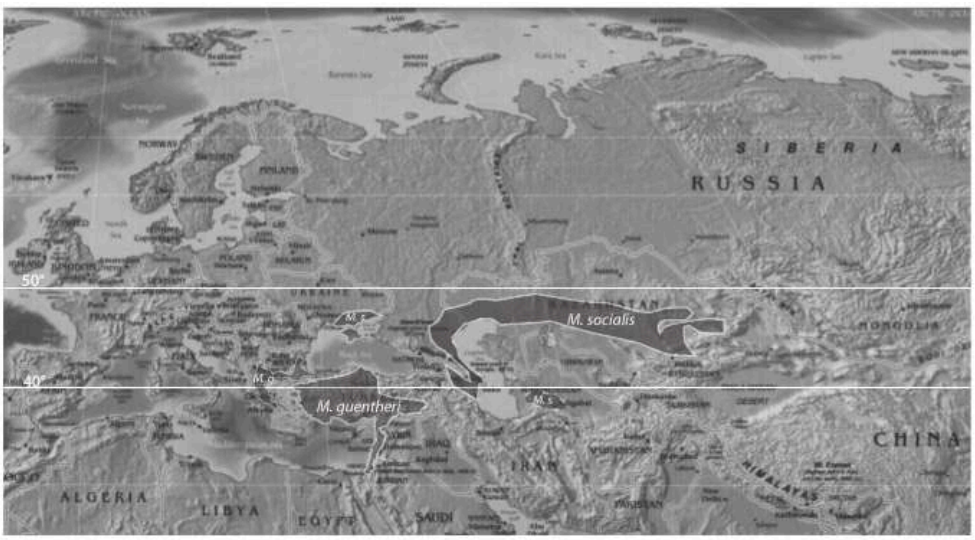
11 The two species differ by their dental morphology and size.

12 Most of the m/1 from these two species are made up of five closed triangles, rarely six, but those of Microtus socialis3 are the only ones with seven closed triangles and sometimes six; they are also the only ones with a protruding t8 (Ognev 1950, fig. 11). In addition, we observe the frequent presence on the posterior end of a protuberance that can attain the shape of a loop on the M/2, which is well established for M. agrestis (cf. fig. 5d). On the M/1, this shape is never so developed and is limited to a more or less voluminous angle (cf. fig. 11). The M/3 displays four bulging lingual and three external angles, but these criteria do not seem to be retained for determinations, probably on account of their instability.

13 M. guentheri (Danford & Alston, 1880) (fig. 12, 13, 14) differs from M. socialis by a larger molar size (M. socialis is the smallest species of the Sumeriomys sub-genus), orange-coloured incisors (Yigit & Çolak 2002) and the fact that the two upper molars do not have posterior agrestoid formations (Baydemir & Duman 2009).

14 M. guentheri can be separated from M. socialis on the basis of its large size. G. Storch (1988) indicates, for the M/ of M. guentheri, an average length of 330 (300-360), which is higher than that of MPG (306; 280-345), but no M/1 dimensions figure in the published studies.

Figure 10 - Distribution map of Microtus socialis and Microtus guentheri.



2.2 - The microtine from Petits Guinards: Microtus bifrons nov. sp.

15 It thus seems that the dental morphology of the microtine from Petits Guinards assimilates it to Microtus socialis, as described by Ognev (1950) if we exclude the adventive formations extending the posterior end of the first two upper molars. These protuberances, with instable size and presence, frequently characterize this taxon. For this point, we follow the denomination defined by Ognev for this very characteristic morphology, which is not found anywhere else. The seven closed reference triangles are present on the microtine from Petits Guinards and M. socialis, but the latter is too small for MPG to be a sub-species. The larger size and morphology of MPG relate it to the sub-genus Sumeriomys (fig. 15), but differentiate it from the two morphotypes; one on account of its shape (M. guentheri), and the other its size (M. socialis), although it conserves a double facies. It is thus difficult to name the vole from Petits Guinards.

16 The excessive size could be an evolutionary sign of the species in a more favourable environment than the semi-desert type conditions of its initial biotope. The “socialis” form described by Ognev (1950) changed little but its size increased considerably to reach the size of M. guentheri (while losing the agrestic formations of the first two upper molars). In this way, this new vole bears the marks of two major Mid-Eastern Sumeriomys taxa. This is why we employ the adjective “bifrons”, denoting the double facies of the first lower molar. The characteristics are the following:

17 MICROTUS BIFRONS nov. sp.
FAMILY: Cricetides
SUB-FAMILY: Microtines
GENUS: Microtus SCHRANK, 1798
SUB-GENUS: Sumeriomys ARGYROPULO, 1933

HOLOTYPE: m1G n° CVPG 57-1248a (fig. 16)
LOCALITY-TYPE: Creuzier-le-Vieux (Allier); locality Les Petits Guinards
TYPE-LEVEL : The whole of the Upper Pleniglacial with Solutrean and Magdalenian industries.
PROBABLE AGE: 20 000 – 11 000 uncal BP
ORIGIN OF THE NAME: from the Latin bifrons: Latin term signifying double face; used on account of the double facies of the m1: Microtus socialis for its polymorphic dental pattern (six to seven closed triangles, rarely five), and Microtus guentheri for its large size and the absence of agrestis type upper molars.
DIAGNOSIS: Large-sized vole with six to seven highly dissymmetrical and acute angled closed triangles on the m1. Highly dissymmetrical anterior loop and voluminous spur-shaped t8.
PARATYPES: M3D with 3 closed triangles, five external protruding angles and four internal protruding angles (cf. fig. 16).

18 We now have better knowledge of the current distribution of M. socialis and guentheri (see above), but can data relating to their former geographic distribution contribute to our understanding of the presence of a vole such as M. bifrons in the Massif Central between 20 000 and 11 000 uncal BP (MIS 2 and the Tardiglacial) and probably derived from Eastern species? Unfortunately, such mentions are rare and are dispersed in space and time (Kowalski 1958; Tchernov 1968; Storch 1988; Gromov & Erbajeva 1995; Helmer et al. 1998; Santel & von Koenigswald 1998; Khenzykhenova et al. 2011; Markova 2011; Maul et al. 2011; Popova 2004). These two Microtus are indicated from the Middle Pleistocene onwards in sites in the Near East, Anatolia, in the north of the Caucasus and in Thrace. The hypothesis of the migration of one or two of these species from Turkey by successive waves since the Middle Pleistocene during the drying of the Bosporus Strait is thus currently preferred.

Figure 11 - Microtus socialis after S.I. Ognev, 1950 - a/ 1- 3: m1D; 1 – Northern Caucasus; M. s. parvus; 2/ Ala Kul Lake (Khirgyzistan): M. s. gravesi; 3/ Kaine-Kassyr (Turkmenistan, near the Iranian border: M. s. paradoxus (Ognev 1950, fig. 163). b/ Structure variations in Microtus socialis molars. 1-3: Salk region; 4: Bakou region; 5-6 Kopet, region Dag. 1,3,4,5,6 : M1-M3D; 2 : m1-m3D. (Ognev 1950, fig. 162). No scale.

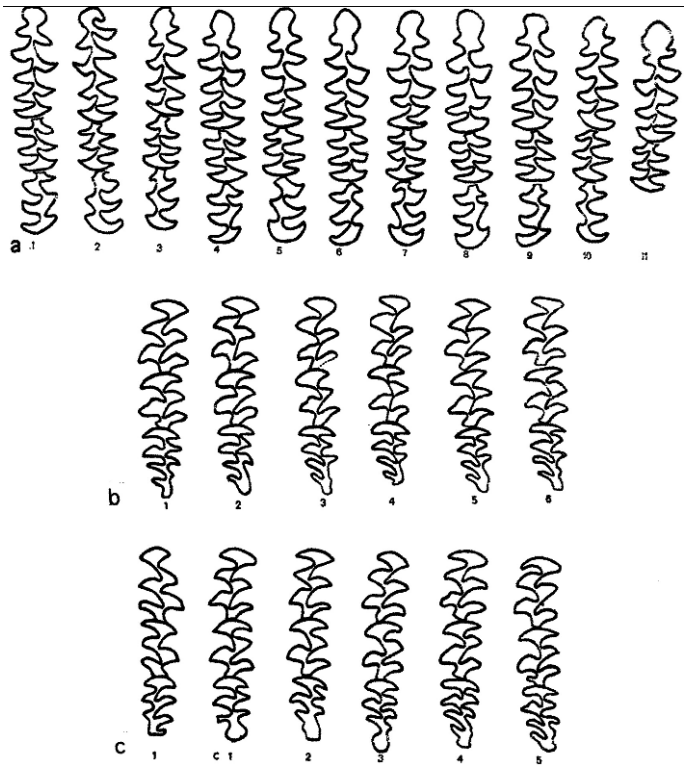


Figure 12 - Microtus guentheri. a/ 1-11: Lower cheek teeth. Acheulean. Oum Qatafa Cave (Israel). Tchernov 1968. b/ 1-6: Upper cheek teeth. Acheulean. Oum Qatafa Cave (Israel). Tchernov 1968. c/ 1: Upper cheek teeth (M1-M3D). Upper Levallloiso-Mousterian. Kebara Cave (Israel). c1-5: Upper cheek teeth G. recent (Tchernov 1968). No scale.

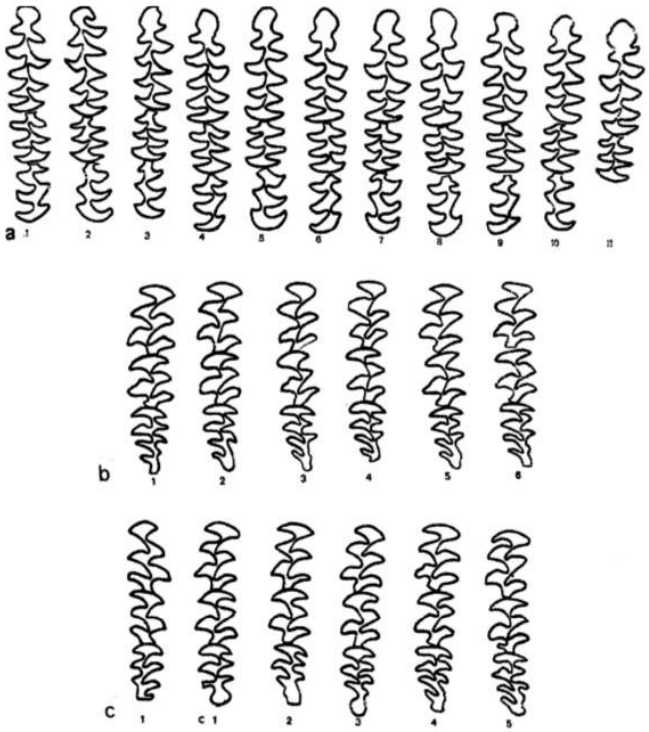


Figure 13 - Microtus guentheri. a & b/ M3D; c & d/ m1-m3D. Kirikkale Province (Turkey). Baydemir & Duman (2009). No scale.

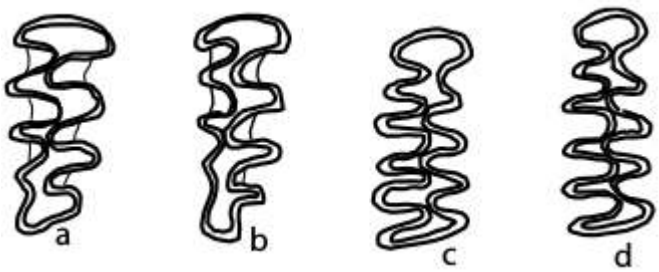


Figure 14 - Microtus guentheri. 10-12: m1G; 13-15: M3G. Microtus arvalis. 13-15: m1; 19-20: M3D. Karain B. (Turkey). Storch (1988). No scale.

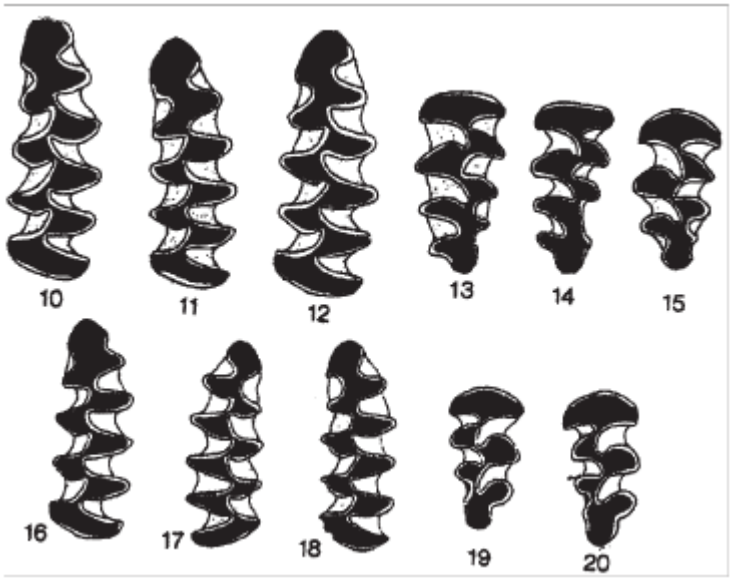


Figure 15 - Sub-genus Sumeriomys – m1D (A, C, E, G, J, K, M, O, R, T, V, X, et Z) & m3D (B, D, H, I, L, N, P, S, U,W,Y, Z& ZZ). A & B: Microtus socialis socialis (Gur'ev, Kazakhstan); C& D: M. s. nikolajevi (Kuyuk-Tuk Island, Ukraine); E & F. M. s. binominatus (Tbilissi, Georgia); G & H: M. s. goriensis (Tamarasheni, Georgia); I & J: M. s. goriensis (Tamarasheni, Géorgia); K & L: M. schidlovvkii (Nalband, Armenia); M & N: M. parvus (Divnoye-Stavropol, Russia); O & P. M. paradoxus (Ashkhabad, Turkmenistan); T & U: M. s. gravesi (Betpakdala Steppe, Kazakhstan); V & W: M. guentheri stranjensis (Sozopol, Bulgaria); X & Y: M. s. zaitsevi (Holotype – Bakou, Azerbaijan); Z & ZZ: M. s. aristovi (Holotype – Veysalli, Azerbaijan). Golenischchev et al. 2002a. Scale 1mm.

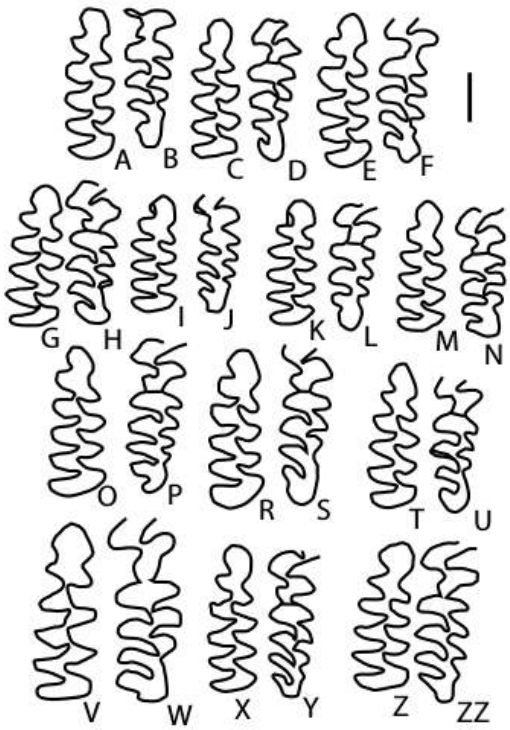
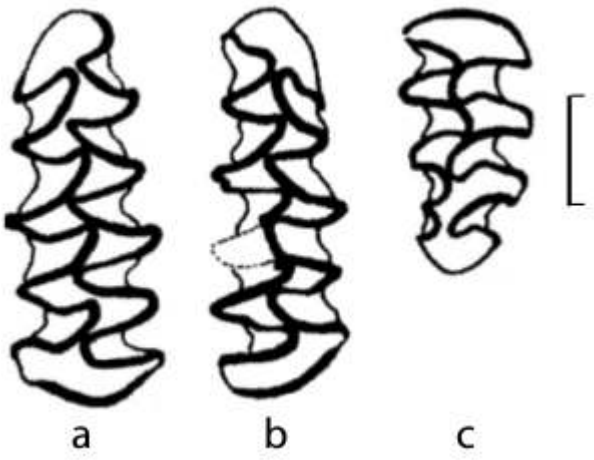


Figure 16 - Microtus bifrons (Petits Guinards). a/Holotype: m1 left. b/ Paratype: m1 right. c/ Paratype: M3 right. Scale 1 mm.



Conclusion

19 Given the major differences between this new form from Petits Guinards and the described microtine species, it seems logical to attribute a specific status to the vole from Petits Guinards in keeping with the developed criteria. These differences were identified on the m1, the most obvious being the increased number of closed triangles and the marked development of the t8 resulting in increased size. The combined association of the dental morphology of Microtus socialis (Pallas, 1773) and the large size of Microtus guentheri (Danford et Alston, 1880) resulted in the name Microtus bifrons nov. sp., indistinctly associating the double facies of both taxa. Due to the focus on North Siberian continental species, we tend to forget that migrations can also occur from east to west, along the same latitudinal gradient, and the association of micromammals from Petits Guinards is an invaluable reminder of this. The history of this lineage of microtines and the arrival of Microtus bifrons in Europe remain to be determined, through the continued study of micromammal remains, which are at times very abundant and very well conserved in the sediments accumulated in caves or rock shelters.

Annex 1 – Metric data from the Microtus arvalis m1 from Petits Guinards (Massif Central).

CVPG: m1 *Microtus arvalis*

N°	Réf	Ech.	N°	LT	a	b2	c2	w2	W1	Wn	WR	Ht4	L1	LBA	Type	BA asym	r/n /ACC	(r/n) /BA
1	CVPG1	1	1	291	155	39	31	80	116	56	52	mdb	87	98	C6	0,93	0,60	0,95
2	CVPG1	1	2	279	152	37	20	81	100	50	40	mdb	84	101	C5	0,80	0,53	0,79
3	CVPG1	1	3	294	164	17	9	85	120	58	49	mdb	86	108	C7	0,84	0,52	0,78
4	CVPG1	1	4	251	134	31	23	70	95	44	42	mdb	76	89	C6	0,95	0,71	1,07
5	CVPG1	1	5	307	169	19	23	75	118	61	50	390	83	109	B	0,72	0,49	0,75
6	CVPG1	1	6	299	171	23	18	78	100	50	45	444	81	109	C3	0,90	0,53	0,83
7	CVPG1	1	7	273	145	19	18	75	110	49	49	383	80	91	C5	1,00	0,69	1,10
8	CVPG2	25	1	283	150	19	24	84	112	60	47	mdb	81	100	C6	0,78	0,51	0,78
9	CVPG2	25	2	279	153	30	23	78	113	58	45	mdb	83	101	C6	0,78	0,51	0,77
10	CVPG2	25	3	266	142	21	23	85	108	56	46	mdb	78	87	C6	0,82	0,58	0,94
11	CVPG2	25	4	318	151	7	23	95	109	51	47	mdb	113	122	G4	0,72	0,61	0,76
12	CVPG2	25	5	276	150	6	29	71	96	47	38	mdb	79	98	G4	0,81	0,54	0,83
13	CVPG2	25	6	299	115	30	16	70	92	39	31	mdb	77	78	C6	0,79	0,69	1,10
14	CVPG2	25	7	271	147	34	29	85	118	63	48	mdb	81	95	D1	0,76	0,52	0,80
15	CVPG2	25	8	245	127	19	18	75	93	56	37	mdb	78	82	D1	0,68	0,52	0,81
16	CVPG2	25	9	298	159	14	16	79	116	57	46	mdb	94	105	G1	0,81	0,51	0,77
17	CVPG2	25	10	261	132	11	19	78	96	44	44	mdb	97	98	G1	1,00	0,81	1,06
18	CVPG2	25	11	270	146	15	15	78	101	43	40	350	80	91	C5	0,93	0,64	1,00
19	CVPG2	25	12	300	167	7	14	70	112	55	50	348	86	114	C5	0,91	0,54	0,80
20	CVPG2	25	13	286	151	13	21	71	111	53	45	343	85	96	C1	0,85	0,56	0,82
21	CVPG2	25	14	289	147	37	29	80	113	59	45	352	87	89	C4	0,78	0,52	0,86
22	CVPG2	25	15	306	175	39	26	85	115	63	46	379	86	103	C6	0,73	0,49	0,71
23	CVPG2	25	16	267	153	25	21	81	110	57	45	396	81	98	E	0,79	0,52	0,81
24	CVPG2	25	17	272	155	20	16	81	102	46	41	310	77	99	C3	0,89	0,58	0,90
25	CVPG2	25	18	293	133	28	14	81	105	53	44	357	87	99	C5	0,83	0,62	0,84
26	CVPG2	25	19	267	135	30	12	70	102	55	41	345	85	88	C6	0,75	0,55	0,91
27	CVPG2	25	20	281	160	18	15	80	102	54	42	332	78	101	C6	0,78	0,49	0,77
28	CVPG2	25	21	275	147	19	11	75	104	52	45	353	80	91	B	0,87	0,59	0,95
29	CVPG2	25	22	263	144	20	18	77	97	50	41	374	76	97	C5	0,72	0,57	0,85
30	CVPG2	25	23	276	143	22	23	89	117	57	51	389	83	90	C3	0,89	0,63	0,99
31	CVPG2	25	24	263	144	19	12	83	105	53	40	354	95	95	C3	0,75	0,52	0,79
32	CVPG2	25	25	254	137	36	16	71	89	47	34	278	78	90	C6	0,72	0,53	0,79
33	CVPG2	25	26	267	142	11	19	82	93	49	33	305	82	97	C6	0,67	0,47	0,69
34	CVPG2	25	27	258	130	29	18	72	95	44	40	331	85	83	C4	0,91	0,70	1,10
35	CVPG2	25	28	275	145	30	25	77	111	55	45	354	86	90	C6	0,72	0,56	0,91
36	CVPG2	25	29	285	154	16	15	83	97	46	37	303	86	103	C7	0,80	0,62	0,78
37	CVPG3	50	1	310	154	35	32	77	104	46	35	388	86	101	C6	0,76	0,49	0,75
38	CVPG3	50	2	260	130	20	21	73	95	43	41	358	89	81	C6	0,95	0,73	1,18
39	CVPG3	50	3	260	141	31	23	71	96	47	36	294	80	95	C5	0,77	0,54	0,81
40	CVPG4	73	1	283	155	25	14	74	109	50	46	mdb	92	97	C9	0,93	0,59	0,95
41	CVPG4	73	2	263	145	17	18	82	101	55	41	mdb	72	98	F2	0,79	0,54	0,80
42	CVPG4	73	3	286	157	21	15	81	111	62	44	mdb	81	101	D1	0,71	0,45	0,70
43	CVPG4	73	4	273	145	13	13	77	108	55	39	346	83	93	C6	0,71	0,49	0,76
44	CVPG4	73	5	259	139	21	16	77	109	61	49	337	78	89	C6	0,80	0,58	0,90
45	CVPG4	73	6	269	139	21	19	85	99	53	32	408	83	86	C6	0,60	0,43	0,70
46	CVPG4	73	7	257	137	24	25	72	91	49	30	308	77	87	C6	0,61	0,45	0,70
47	CVPG4	73	8	276	139	11	20	83	110	59	38	348	90	89	C3	0,64	0,46	0,72
48	CVPG5	93	1	301	173	19	32	84	120	60	50	mdb	96	109	B	0,83	0,48	0,76
49	CVPG5	93	2	276	149	36	19	83	109	51	49	mdb	76	92	C6	0,96	0,64	1,04
50	CVPG5	93	3	295	156	32	18	82	112	55	47	mdb	85	99	C6	0,85	0,55	0,86
51	CVPG5	93	4	289	163	30	19	80	114	54	46	mdb	86	106	C8	0,85	0,52	0,80
52	CVPG5	93	5	249	131	27	38	83	96	49	36	mdb	81	79	C4	0,75	0,57	0,95
53	CVPG5	93	6	291	156	17	32	88	107	52	38	406	86	103	C6	0,73	0,47	0,71
54	CVPG5	93	7	265	144	18	17	75	91	46	37	356	78	94	C8	0,80	0,56	0,86
55	CVPG5	93	8	248	124	25	18	81	91	53	30	340	84	74	C4	0,57	0,46	0,76
56	CVPG5	93	9	273	148	19	17	74	95	47	38	381	83	95	C5	0,81	0,57	0,85
57	CVPG5	93	10	278	149	36	33	79	106	47	46	387	76	94	C8	0,98	0,66	1,04
58	CVPG5	93	11	260	145	30	19	82	106	54	43	342	80	93	C8	0,80	0,55	0,86
59	CVPG5	93	12	231	128	32	18	73	95	52	33	259	68	80	C8	0,63	0,52	0,79
60	CVPG6	117	1	265	142	36	15	80	112	53	45	mdb	79	87	C1	0,85	0,60	0,98
61	CVPG6	131	1	270	145	35	17	78	110	55	42	340	80	96	C8	0,76	0,53	0,80
62	CVPG6	131	2	301	163	32	18	84	107	49	42	394	92	104	D5	0,86	0,53	0,82
63	CVPG9	156	1	279	153	39	18	80	106	51	49	mdb	83	94	C8	0,96	0,63	1,00
64	CVPG9	156	2	285	156	10	33	76	104	51	40	mdb	78	105	D3	0,78	0,50	0,75
65	CVPG9	156	3	285	158	19	19	77	114	55	45	mdb	87	96	C5	0,82	0,54	0,85
66	CVPG9	156	4	282	156	19	23	84	113	55	47	mdb	79	99	C3	0,85	0,54	0,86
67	CVPG9	156	5	278	153	19	17	83	101	51	38	mdb	83	100	C5	0,75	0,49	0,75

	LT	a	b2	c2	w2	W1	Wn	WR	Ht4	L1	LBA	Type	asym	/ACC	/BA
nb	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67
X	276	276	276	276	276	276	276	276	276	276	276	276	276	276	276
Mx	307	175	39	34	95	120	63	58	444	113	122	0	1,00	0,81	1,18
mn	225	115	6	9	70	92	39	30	258	68	78	0	0,57	0,46	0,69
sd	9,2	1,4	4,9	4,8	3,1	10,6	3,5	5,9		0,8	1,4		0,1	0,1	0,1

Annex 2 – Metric data from Microtus agrestis m1 from Petits Guinards (Massif Central).

Annexe 2. CVPG: m1 *Microtus agrestis*

N°	Réf	LT	a	b2	c2	W2	W1	Wn	Wr	Ht4	L1	LBA	Type	r/n asym	(r/n)/ /ACC	(r/n)/ /BA	b2/W2	b2/c2	c2/W2
1	184-1	314	174	18	20	88	115	54	52	/mdb	90	114	C	0,96	0,55	0,84	0,20	0,90	0,23
2	184-2	294	163	23	20	80	110	54	41	389	87	105	D2	0,76	0,47	0,72	0,29	1,15	0,25
3	184-3	321	187	26	21	87	115	57	48	440	88	128	D2	0,84	0,45	0,66	0,30	1,24	0,24
4	184-4	302	164	15	18	83	98	50	40	408	91	106	C	0,80	0,49	0,75	0,18	0,83	0,22
5	184-5	312	172	21	11	87	114	53	41	346	93	114	C	0,77	0,45	0,68	0,24	1,91	0,13
6	184-6	269	146	16	10	81	102	40	31	344	76	85	C	0,78	0,53	0,91	0,20	1,60	0,12
7	283-1	299	170	18	13	76	106	53	44	/mdb	86	106	C	0,83	0,49	0,78	0,24	1,38	0,17
8	287-1	302	168	22	26	77	109	56	44	371	81	110	C	0,79	0,47	0,71	0,29	0,85	0,34
9	317-1	282	153	11	3	84	108	54	44	/mdb	84	99	F3	0,81	0,53	0,82	0,13	3,67	0,04
10	317-2	293	157	36	28	89	115	60	51	/mdb	85	101	D2	0,85	0,54	0,84	0,40	1,29	0,31
12	317-4	291	153	26	19	96	131	58	44	365	92	93	E1	0,76	0,50	0,82	0,27	1,37	0,20
13	371-1	256	144	27	19	79	93	45	36	319	73	98	C	0,80	0,56	0,82	0,34	1,42	0,24
14	372-1	296	155	19	18	85	113	57	48	/mdb	95	97	D2	0,84	0,54	0,87	0,22	1,06	0,21
15	372-2	245	137	16	7	84	95	48	42	329	75	93	E2	0,88	0,64	0,94	0,19	2,29	0,08
16	372-5	318	177	13	12	80	109	60	41	336	91	113	C	0,68	0,39	0,60	0,16	1,08	0,15
17	372-6	294	156	21	20	85	107	58	45	407	92	100	C	0,78	0,50	0,78	0,25	1,05	0,24
18	400-1	275	146	26	19	84	111	52	49	343	83	93	C	0,94	0,65	1,01	0,31	1,37	0,23
19	400-2	314	169	18	12	82	114	55	44	/mdb	95	110	E2	0,80	0,47	0,73	0,22	1,50	0,15
20	400-3	318	166	18	16	80	110	56	45	/mdb	96	110	C	0,80	0,48	0,73	0,23	1,13	0,20
21	400-4	297	159	16	22	74	118	58	47	429	88	99	C	0,81	0,51	0,82	0,22	0,73	0,30
22	400-5	311	169	21	22	73	108	56	41	/mdb	91	112	C	0,73	0,43	0,65	0,29	0,95	0,30
23	400-6	289	142	21	22	73	108	60	44	/mdb	85	92	C	0,73	0,52	0,80	0,29	0,95	0,30
24	400-7	287	166	23	17	84	101	52	41	342	81	109	C	0,79	0,47	0,72	0,27	1,35	0,20
25	429a-1	294	162	32	24	86	107	57	42	420	85	100	D2	0,74	0,45	0,74	0,37	1,33	0,28
27	429a-2	276	149	29	25	76	105	48	41	346	80	94	C	0,85	0,57	0,91	0,38	1,16	0,33
28	459-1	322	174	19	33	83	121	64	52	418	95	109	D2	0,81	0,47	0,75	0,23	0,58	0,40
29	459-2	273	151	19	14	80	98	53	38	334	84	99	C	0,72	0,47	0,72	0,24	1,36	0,18
30	453-3	306	170	9	21	81	115	62	46	398	86	114	D3	0,74	0,44	0,65	0,11	0,43	0,26
31	453-4	288	159	15	24	76	114	64	45	316	82	109	D2	0,70	0,44	0,65	0,20	0,63	0,32
32	453-5	310	174	22	19	89	104	53	41	353	88	113	D3	0,77	0,44	0,68	0,25	1,16	0,21
33	453-6	285	144	17	19	71	97	54	37	328	79	90	D3	0,89	0,48	0,76	0,24	0,89	0,27
34	453-7	309	171	19	27	91	128	64	55	/mdb	89	113	C	0,86	0,50	0,76	0,21	0,70	0,30
35	453-8	281	150	29	20	77	109	54	47	399	88	95	D2	0,87	0,58	0,92	0,38	1,45	0,26
36	453-9	281	154	23	9	88	103	47	39	320	80	98	F2	0,83	0,54	0,85	0,26	2,56	0,10
37	453-10	288	145	5	19	80	98	51	39	295	69	100	A3	0,76	0,53	0,76	0,06	0,26	0,24
	n	35	35	35	35	35	35	35	35	25	35	35	0	35	35	35	35	35	35
	X	292,3	159,9	20,26	18,54	81,97	108,8	54,77	43,57	363,8	85,8	103,5		0,80	0,50	0,78	0,25	1,24	0,23
	max	322,0	187	36	33	96	131	64	55	440	96	128	0	0,96	0,65	1,01	0,40	3,67	0,40
	min	245,0	137	5	3	71	93	40	31	295	69	85	0	0,68	0,39	0,60	0,06	0,26	0,04
	sd	19,62	11,97	6,321	6,247	5,649	8,539	5,353	4,937	40,94	6,566	9,176		0,06	0,06	0,09	0,07	0,63	0,08

Annex 3 – Metric data from the present-day Microtus agrestis m1 (Brittany).

Coll.Leb: m1 -*Microtus agrestis* breton actuel													r/n	(r/n)	(r/n)			
N°	Réf	LT	A	B2	C2	W2	WΔ	WN	WR	LΔ	LBA	Type	asym	/ACC	/BA	B2/W2	B2/C2	C2/W2
1	1-1	283	154	26	26	74	102	53	37	78	100	C	0,70	0,45	0,70	0,35	1,00	0,35
2	3-1	267	145	19	18	79	97	56	33	83	87	C	0,59	0,41	0,68	0,24	1,06	0,23
3	3-2	283	138	22	14	68	109	61	35	82	85	C	0,57	0,42	0,68	0,32	1,57	0,21
4	5-1	245	127	23	24	71	102	55	39	77	76	A3	0,71	0,56	0,93	0,32	0,96	0,34
5	6-1	270	152	21	6	87	99	56	34	73	98	E2	0,61	0,40	0,62	0,24	3,50	0,07
6	11-1	257	140	23	19	80	108	58	41	73	89	C	0,71	0,50	0,79	0,29	1,21	0,24
7	A11	290	154	12	18	86	108	51	37	87	93		0,73	0,47	0,78	0,14	0,67	0,21
8	A12	263	144	21	13	83	99	55	29	77	92		0,53	0,37	0,57	0,25	1,62	0,16
9	A21	274	150	21	22	73	105	50	35	83	94		0,70	0,47	0,74	0,29	0,95	0,30
10	B21	270	147	29	26	84	108	57	38	76	91		0,67	0,45	0,73	0,35	1,12	0,31
11	B52	288	147	21	27	80	114	61	43	79	90		0,70	0,48	0,78	0,26	0,78	0,34
12	B72	261	141	34	18	77	103	53	38	76	89		0,72	0,51	0,81	0,44	1,89	0,23
13	B82	282	155	28	23	85	109	63	34	83	97		0,54	0,35	0,56	0,33	1,22	0,27
14	B83	277	147	29	21	77	110	60	37	84	84		0,62	0,42	0,73	0,38	1,38	0,27
15	D11	264	138	22	25	83	104	56	37	79	83		0,66	0,48	0,80	0,27	0,88	0,30
16	D42	284	151	11	15	88	110	57	34	87	97		0,60	0,40	0,61	0,13	0,73	0,17
17	D43	248	134	20	21	77	99	54	36	73	85		0,67	0,50	0,78	0,26	0,95	0,27
18	D61	255	134	21	16	70	103	54	40	81	80		0,74	0,55	0,93	0,30	1,31	0,23
19	D62	288	168	26	26	75	108	60	37	76	105		0,62	0,37	0,59	0,35	1,00	0,35
20	D92	255	139	36	25	87	107	61	37	76	85		0,61	0,44	0,71	0,41	1,44	0,29
21	D101	272	144	28	9	92	105	54	36	81	93		0,67	0,46	0,72	0,30	3,11	0,10
22	D151	275	148	17	20	76	107	55	37	82	90		0,67	0,45	0,75	0,22	0,85	0,26
23	D161	276	154	23	13	76	105	51	39	80	96		0,76	0,50	0,80	0,30	1,77	0,17
24	E11	267	142	15	17	89	112	61	37	78	96		0,61	0,43	0,63	0,17	0,88	0,19
25	AI11	298	163	16	12	80	103	58	33	86	101	B2	0,57	0,35	0,56	0,20	1,33	0,15
26	AI12	259	131	15	16	72	83	46	26	78	80	C	0,57	0,43	0,71	0,21	0,94	0,22
27	AI21	268	145	18	16	81	103	62	35	77	93	C	0,56	0,39	0,61	0,22	1,13	0,20
28	AI31	257	134	28	24	82	103	56	34	82	80	C	0,61	0,45	0,76	0,34	1,17	0,29
29	AI32	271	139	25	23	76	105	58	33	86	84	A3	0,57	0,41	0,68	0,33	1,09	0,30
30	AI33	272	151	24	17	82	112	59	41	78	93	C	0,69	0,46	0,75	0,29	1,41	0,21
31	AI41	313	163	36	28	80	111	52	33	97	94	A3	0,63	0,39	0,68	0,45	1,29	0,35
32	AI51	287	156	30	14	87	109	58	39	83	92	A1	0,67	0,43	0,73	0,34	2,14	0,16
33	AI52	282	152	27	21	86	107	57	38	83	90	F2	0,67	0,44	0,74	0,31	1,29	0,24
34	AI61	249	127	18	12	70	85	60	26	79	80	C	0,43	0,34	0,54	0,26	1,50	0,17
35	AI62	243	126	28	8	78	96	51	31	76	81	C	0,61	0,48	0,75	0,36	3,50	0,10
36	AI81	293	155	30	17	80	107	55	39	86	94	C	0,71	0,46	0,75	0,38	1,76	0,21
37	AI82	269	138	28	27	77	106	56	40	81	83	A3	0,71	0,52	0,86	0,36	1,04	0,35
38	AI91	261	136	19	2	85	101	51	31	81	87	F2	0,61	0,45	0,70	0,22	9,50	0,02
39	AI101	270	152	20	20	83	101	55	34	73	101	E2	0,62	0,41	0,61	0,24	1,00	0,24
40	AI111	279	151	22	14	84	107	56	36	84	94	C	0,64	0,43	0,68	0,26	1,57	0,17
41	AI112	278	149	22	17	84	111	62	33	79	95	B2	0,53	0,36	0,56	0,26	1,29	0,20
42	AI141	265	141	23	16	82	103	54	34	80	87	C	0,63	0,45	0,72	0,28	1,44	0,20
43	AI151	284	157	13	11	104	114	61	39	77	99	B2	0,64	0,41	0,65	0,13	1,18	0,11
44	AI152	241	133	26	22	77	88	44	29	70	80	E1	0,66	0,50	0,82	0,34	1,18	0,29
45	AI161	236	129	15	11	78	92	52	27	70	86	C	0,52	0,40	0,60	0,19	1,36	0,14
46	AI171	285	150	35	18	76	108	53	41	86	93	C	0,77	0,52	0,83	0,46	1,94	0,24
48	AI172	292	160	17	17	80	111	55	38	83	99	A1	0,69	0,43	0,70	0,21	1,00	0,21
49	AI181	248	121	29	16	78	90	47	29	79	71	A2	0,62	0,51	0,87	0,37	1,81	0,21
50	AI201	148	132	20	21	72	84	42	25	74	85	C	0,60	0,45	0,70	0,28	0,95	0,29
51	AI153	285	159	12	2	88	111	57	38	79	102	F3	0,67	0,42	0,65	0,14	6,00	0,02
52	AI182	244	123	31	4	78	90	49	28	77	73	F2	0,57	0,46	0,78	0,40	7,75	0,05
	n	51	51	51	51	51	51	51	51	51	51	0	51	51	51	51	51	51
	X	267,7	144,4	23,0	17,4	80,3	103,4	55,3	35,1	79,8	89,6		0,6	0,4	0,7	0,3	1,8	0,2
	Max	313	168	36	28	104	114	63	43	97	105	0	0,77	0,56	0,93	0,46	9,50	0,35
	min	148	121	11	2	68	83	42	25	70	71	0	0,43	0,34	0,54	0,13	0,67	0,02
	sd	23,60	11,13	6,29	6,43	6,43	7,75	4,65	4,30	4,92	7,73		0,07	0,05	0,09	0,08	1,67	0,08

Annex 4 – Metric data from the Microtus bifrons m1 from Petits Guinards (Massif Central).

Annexe 4: CVPG: m1 *M. bifrons*				: Holotype de *Microtus bifrons* nov. sp										(r/n)
N°	**Référence**		**LT**	**a**	**b2**	**c2**	**W2**	**WΔ**	**Wn**	**Wr**	**Ht4**	**LΔ**	**LBA**	**asym**
	Éch	Lot												
1	16	316	318	169	10	24	88	117	59	49	/Mdb	93	111	0,83
2	18	371	304	167	18	23	80	107	53	43	399	92	108	0,81
3	47	957	345	198	6	8	93	119	48	43	439	92	135	0,90
4	48	988	310	177	9	11	101	116	52	48	449	80	118	0,92
5	51	1065	298	165	10	18	91	112	57	48	355	87	106	0,84
6	56	1213	295	145	7	4	89	110	57	43	423	90	90	0,75
7	59	1309	322	174	6	15	81	108	51	41	/Mdb	97	117	0,80
8	24	517a1	293	163	8	9	88	108	55	42	357	90	108	0,76
9	24	517a2	292	165	4	3	80	106	49	44	384	82	115	0,90
10	39	780a	287	135	5	1	84	100	52	36	432	85	105	0,69
11	53	1118a	317	181	17	2	96	110	55	41	391	89	120	0,75
12	55	1181a	292	159	1	5	84	118	65	47	375	83	109	0,72
13	57	1248a	307	169	12	16	84	105	54	39	404	92	111	0,72
14	57	1248b	345	192	1	4	100	124	64	47	/Mdb	103	125	0,73
15	60	1346	280	157	5	14	89	101	49	41	/Mdb	83	103	0,84
		n	15	15	15	15	15	15	15	15	11	15	15	15
		moy.	307,0	167,7	7,9	10,5	88,5	110,7	54,7	43,5	400,7	89,2	112,1	0,80
		max	345	198	18	24	101	124	65	49	449	103	135	0,92
		min	280	135	1	1	80	100	48	36	355	80	90	0,69
		SD	19,55	16,10	4,98	7,56	6,73	6,87	5,09	3,72	32,13	6,13	10,44	0,07

Annex 5 – Metric data from present-day Microtus hyperboreus m1 (Yakutie).

Annexe 5 - *Microtus hyperboreus* actuel de Yakutie													
		LT	a	b2	c2	w2	WΔ	Wn	Wn	Ht4	LΔ	LBA	Asym
	n	6	6	6	6	6	6	6	6		6	6	6
	X	275,7	143	20	15	87	105	52	62		85	85	1,19
	max	287	151	29	26	91	110	58	70		90	93	1,21
	min	257	127	10	4	78	101	45	48		78	67	1,07

BIBLIOGRAPHY

BAYDEMIR A. N., DUMAN L. 2009 – Molars patterns in *Microtus guentheri* (Danford & Alston, 1880) (Mammalia, Rodentia) from Kirikkale Province. *Journal of applied Biological Sciences*, 3 (3), p. 47-53.

CHALINE J. 1972 – Les rongeurs de l'aven I des Abîmes de La Fage à Noailles (Corrèze). Nouv. Archives du Muséum d'Histoire Naturelle de Lyon, Fasc. 10, p. 61-78.

CHAUVIÈRE F.-X., FONTANA L., LANG L., BONANI G., HADJAS I. 2006 – Une préhampe magdalénienne en bois de renne aux Petits-Guinards (Allier, France).*C.R. Palevol, 5*, p. 725-733.

CORBET G. B. 1978 – *The Mammals of the Palearctic Region: a taxonomic review.* London: British Museum (Natural History), Cornell University Press, 314 p.

CUENCA-BESCOS G., STRAUS L.G., GARCIA-PIMIENTA J.C., GONZALES-MORALES M.R., LOPEZ-GARCIA. J.M. 2010 – Late Quaternary small mammal turnover in the Cantabrian Region: The extinction of *Pliomys* lenli (*Rodentia, Mammalia*). *Quaternary International* 212, p. 129-136.

DESCLAUX E., DEFLEUR A. 1997 – Étude préliminaire des micromammifères de la Baume Moula-Guercy. *Quaternaire*, 8 (2-3), p. 213-223.

FONTANA L., CHAUVIÈRE F.-X. 2009 – The total exploitation of Reindeer at the site of Les Petits Guinards: What's new about the annual cycle of Magdalenian groups in the French Massif Central? *In:* L. Fontana, F.-X Chauvière & A. Bridault (eds): *In search of Total Animal Exploitation. Case Studies from the Upper Palaeolithic and Mesolithic*. Proceedings of the XVth UISPP World Congress, Lisbon, 4-9 September 2006, Session C 61, vol. 42. Oxford, J. & E. Hedges (BAR International series 2040), p. 101-111.

FONTANA L., LANG L., CHAUVIÈRE F.-X., JEANNET M., MAGOGA L. 2003a – Nouveau sondage sur le site Paléolithique des Petits-Guinards à Creuzier-le-Vieux (Allier, France) : des données inattendues. *Bulletin de la Société préhistorique française*, 100 (3), p. 591-596.

FONTANA L., LANG L., CHAUVIÈRE F.-X., JEANNET M., MOURER-CHAUVIRÉ C., MAGOGA, L. 2003b – Paléolithique supérieur récent du nord du Massif Central : des données inattendues sur le site paléolithique des Petits Guinards à Creuzier-le-Vieux (Allier, France), *Préhistoire du Sud-Ouest* 10/1, p. 77-93.

FONTANA L., AUBRY T., ALMEIDA M., CHAUVIÈRE F.-X., DIGAN M., MANGADO J., WALTER B., LANG L. 2013 – Premières traces des Solutréens dans le Massif Central français. *In :* Th. Aubry & M. Almeida (eds) : *Le Solutréen... 40 ans après Smith 66*. Actes du colloque de Preuilly-sur-Claise (2007), 47è supp. de la RACF, p. 239-246.

GOLENISCHCHEV F., MALIKO V. G., NAZARD F., VAZIRI A. S., SABLINA O. V., POLYAKOV A. V. 2002a – New species of vole of « guentheri » group (Rodentia, *Arvicolinae, Microtus)* from Iran. *Russian Journal of Theriology*, I (2), p. 117-123 (En russe).

GOLENISCHCHEV F. N., SABLINA O. V., POLJAKOV P. M., GERASIMOV S. 2002b – Taxonomy of the subgenus *Sumeriomys* Argyropulo, 1933. *Russian Journal of Theriology*, I (1), p. 43-55 (En russe).

GROMOV I. M., ERBAJEVA M. A. 1995 – *The Mammals of Russia and adjacent territories.* Saint-Pertersburg: Russian Academy of Sciences. Zoological Institut. 521 p. (En russe).

HELMER D., ROITEL V., SANA SEGUL M., WILLCOX G. 1998 – *Interprétations environnementales des données archéologiques et archéobotaniques en Syrie du Nord, de 16 000 BP à 7 000 BP et les débuts de la*

domestication des plantes et des animaux. In Lyon : Maison de l'Orient et de la Méditerranée Jean Pöuilloux : (1-2) : p. 69-33.

HIBBARD C. W. 1950 – Mammals of the Rerxod formation from Fox Canyon, Kansas. *Contributions from the Museum of Paleontology. University of Michigan*, 8, 6, p. 113-192.

JAAROLA M., MARTINKOVA N., GÜNDÜZ I., BRUHOFF C., ZIMA J., NADAKOWSKI A., AMORI G., BULATOVA N., CHONDROPOULOS B., FRAGUDZKIS-TSOLIS S., GONZÁLEZ-ESTEBAN J., LOPEZ-FUSTER M. J., KANDAUROV A. S., KEFELIOGU H., MATHIAS M. L., VILLATE I., SEARLE J. B. 2004 – Molecula phylogeny of the species vole genus *Microtus* (Arvicolinae, Rodentia) inferred from mitochondrial DNA sequences. *Molecula phylogenics and Evolution,* 33, p. 647-663.

KHENZYKHENOVA F., SATO T., LIFNINA E., MENDENEV G., KATO H., KOGAÏ S., MAXIMENKO K., NOVOSEL'ZEVA V. 2011 – Upper palaeolithic mammal faunas, of the Baïkal region, east Siberia (new data). *Quaternary International*, 231, p. 50-54.

KOWALSKI K. 1958 – *Microtus socialis (*Pallas) (Rodentia) in the Lebanon mountains. *Acta theriologica*, II (13), p. 269-279.

KRYSTUFEK B., KEFELIOGLU H. 2001 – Re description and species limits of *Microtus irani* Thomas 1921 and description of a new social vole from Turkey (Mammalia, Arvicolinae). *Bonner Zoologische Beiträge* 50 (1-2), p. 1-14.

MARKOVA A. K. 2011 – Small mammals of the Palaeolithic sites of Crimea. *Quaternary International,* 231, p. 22-27.

MAUL L. K. T., SMITH R., BARKAÏ A., BARASH P., KARKANAS P., SHAHAC-GROSS R., GOPHER A. 2011 – Microfaunal remains at Middle Pleistocene Qesem Cave, Israël: Preliminary results of small vertebrates environment and biostratigraphy. *Journal of Human Evolution*, 60, p. 464-480.

OGNEV S. I. 1950 – *Mammals of the USSR and adjacent countries,* Vol VII, Rodents. London: Oldbourne Press, 625 p.

POPOVA L. V. 2004 – The micromammal fauna of the Dnieper modern channel alluvium: Taphonomic and biostratigraphic implications. *Quaternaire,* 15 (1-2), p. 233-242.

SANTEL W., KOENIGSWALD W. von 1998 – Preliminary report on the Middle Pleistocene small mammal fauna from Yarimburgaz Cave in Turkish Thrace. *Eizeitalter und Gegenswart*, 48, p. 162-169.

SESE C. 2005 – Aportation de los micromammiferos al conocimento paleoambiantal del Pleistoceno superior de la Region Cantàbrica : Nuevos datas y sintesis. *Museo de Altamira. Monografias* n° 20, p. 167-200.

STORCH G.1988 – Eine jungpleistozäne / altholozäne Nager Abfolgie von Antalya, S. W. Anatolien (Mammalia, Rodentia). *Zeitschrift für Säugetierkunde*, 53, p. 76-82.

TCHERNOV E. 1968 – *Succession of Rodents fauna during the upper Pleistocene of Israël.* Hambourg & Berlin: Verlag Peul Parey, 152 p.

VAN DER MEULEN A. J. 1973 – Middle Pleistocene Smaller Mammals from the Monte-Peglia, (Orvieto, Italy) with Special Reference to the Phylogeny of Microtus (Arvicolidae, Rodentia). *Quaternaria,* XVII, p. 1-144.

YIGIT N., ÇOLAK E. 2002 – On the distribution and taxinomic status of *Microtus guentheri* (Danford & Alston, 1880) and *Microtus lydius* Blackler, 1916 (Mammalia, Rodentia) in Turkey. *Turkish Journal of Zoology,* 26, p. 197-204.

YIGIT N., ÇOLAK E., SÖZEN M., OZKURT S. 2003 – A study on the geographical distribution along with habitat aspect of rodent species in Turkey. *Bonn Zool. Beit.*, 50 (4), p. 355-368.

YIGIT N., MARKOV G., ÇOLAK E., KOCHEVA M., SAYGILI F, YUCE D., GAM P. 2012 – Phenotypic features of the « Guentheri » group vole (Mammalia, Rodentia) in Turkey and South Bulgaria: Evidence for its taxonomic detachment. *Acta zoologica Bulgarica,* 64 (1), p. 23-32.

ABSTRACTS

In a crept deposit, the only preserved part of the Magdalenian and Solutrean site of Les Petits Guinard (Allier, France), many thousands of Rodent bones and teeth have been identified. Among the numerous remains of local and boreal voles, one is unknown in France. It has been compared to the nearest morphological and geographical morphotypus: *Microtus arvalis, agrestis, agrestis* Leb. (temperate species), *hyperboreus* (boreal species), *socialis* and *guentheri* (eastern species). Biometrical data of these morphotypus (*socialis* excepted) have also been analysed. The whole data analysis clearly demonstrates that this vole of Les Petits Guinards is not one of the mentioned species, neither a sub-species. Never identified in France, living or fossilised, it is considered as a new species, called *Microtus bifrons nov. sp.*

Au sein d'une loupe de glissement constituant la seule partie conservée du site magdalénien et solutréen des Petits Guinards (Allier, France), plusieurs milliers de restes de rongeurs ont été identifiés. Parmi les nombreux restes de campagnols locaux et boréaux, un campagnol inconnu en France a été distingué. Il a été comparé aux types les plus proches morphologiquement et géographiquement : *Microtus arvalis*, *Microtus agrestis*, *Microtus agrestis* Leb. (tempérés), *Microtus hyperboreus* (boréal), *Microtus socialis* et *Microtus guentheri* (orientaux). Les données biométriques ont également été utilisées pour cinq de ces six morphotypes (*socialis* exclu). L'analyse de l'ensemble des données démontre que le microtiné des Petits Guinards n'appartient à aucune de ces espèces et qu'il ne peut en être une sous-espèce. Ce campagnol jamais signalé en France, voire même en Europe à l'état fossile, est donc identifié comme une nouvelle espèce, que nous nommons *Microtus bifrons nov. sp.*

INDEX

Keywords: Les Petits Guinards, Massif central, Vole, Microtinae, Microtus bifrons nov. sp., Upper Pleniglacial
Mots-clés: Les Petits Guinards, Massif central, Pléniglaciaire supérieur, Campagnol, Microtinés, Microtus bifrons nov. Sp.

AUTHORS

MARCEL JEANNET

UMR 7269 LAMPÉA, BP 647, Maison Méditerranéenne des Sciences de l'Homme, 5 rue du château de l'horloge - BP 647, FR-13094 Aix-en-Provence cedex - m.jeannet.arpa.mf@wanadoo.fr

LAURE FONTANA

(b) CNRS, UMR 7401 ArScAn, Archéologies environnementales. Maison de l'Archéologie et de l'Ethnologie R. Ginouvès, 21 Allée de l'Université, FR-92023 Nanterre cedex - laure.fontana@mae.u-paris10.fr